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Description

CYLINDER PRESSURE TRANSDUCER AND RELATED METHOD

BACKGROUND OF INVENTION

[0001] This invention relates to pressure transducers and, more specifically, to a pressure transducer that can withstand sour gas environments typically experienced with hydrogen reciprocating compressors.

[0002] Current pressure transducers used in hydrogen reciprocating compressors have a relatively short life due to chemical attack on the diaphragm as the result to sulfide stress cracking, hydrogen embrittlement and chloride cracking. Typically, the pressure transducers use a 316 L stainless steel diaphragm, the life of which varies with the concentration of the sulfides and chlorides present in the gas stream. Diaphragm failure frequently occurs in less than one year of service and in some cases less than two months of service. Customer expectations, on the other hand, are in the three to five year range and therefore, it

would be desirable to provide a pressure transducer with an increased life expectancy and particularly in sour gas environments typically found with hydrogen reciprocating compressors.

SUMMARY OF INVENTION

[0003] In accordance with an exemplary embodiment of this invention, a piezo-resistive pressure transducer utilizes a diaphragm constructed of a nickel-based alloy known as C-276, with a noble metal plating, e.g., 24K gold plating. The C-276 alloy material is also employed for all exterior wetted surfaces on the pressure transducer. In manufacturing the device, welding to assemble all of the wetted components is achieved without filler material, and the gold plating of the diaphragm is done after welding.

[0004] It is expected that the pressure transducer as described above will last up to five years (approximately 1 billion cycles) in hydrogen reciprocating compressors with sulfides and chlorides present in the gas stream. In other words, by utilizing these materials, chemical attack on the diaphragm will be greatly reduced, resulting in significant life extension.

[0005] Accordingly, in its broader aspects, the present invention relates to a pressure transducer for a hydrogen recipro-

cating compressor in a sour gas environment comprising a sensor head including a diaphragm mounted on a free end of the sensor head; wherein the diaphragm is constructed of a nickel-based alloy with gold plating on an exposed side thereof.

[0006] In another aspect, the invention relates to a pressure transducer for a hydrogen reciprocating compressor in a sour gas environment comprising a sensor head including a diaphragm mounted on a free end of the sensor head; wherein the diaphragm is constructed of a C-276 nickel-based alloy with gold plating on an exposed side thereof; and wherein the sensor head includes a threaded end portion and an integral hex nut that are also constructed of C-276 nickel-based alloy.

[0007] In still another aspect, the invention relates to a method of monitoring line pressure in a reciprocating hydrogen compressor in a sour gas environment comprising a) providing a pressure transducer having a sensor head and a diaphragm located flush with a free end of the sensor head composed of a nickel-based alloy; b) applying gold plating to one side of the diaphragm; and c) mounting the pressure transducer in a reciprocating compressor with the one side exposed to the sour gas.

[0008] The invention will now be described in connection with the single drawing figures identified below.

Brief Description of Drawings

[0009] The FIGURE is a side elevation of a cylinder pressure transducer in accordance with an exemplary embodiment of the invention.

Detailed Description

[0010] With reference to the single drawing Figure, a cylinder pressure transducer 10 of the piezo-resistive type that includes a sensor head 12 at one end thereof, and a housing 14 at an opposite end, connected by a transducer cable 16. The electronics of the device have been relocated from the sensor head 12 to the housing 14 to achieve better temperature performance. The cable 16 may be wrapped or enclosed in any suitable armor 18 if desired. The sensor head 12 includes a threaded end portion 20 having a flush-mounted diaphragm 22 at the free end thereof. An O-ring 24 is located between the threaded end portion 20 and an integral hex nut 26 by which the transducer is threadably engaged in, for example, a correspondingly threaded aperture in a reciprocating compressor housing (not shown). The sensor head 12 lies axially

adjacent the hex nut 22 in a direction toward the housing 14.

[0011] This invention is concerned primarily with the diaphragm 22 and the so-called "wetted surfaces" within the phantom box 28 including the threaded portion 20 and hex nut 26.

[0012] In accordance with an exemplary embodiment of this invention, the diaphragm 22 is constructed of a C-276 nickel-based alloy that is particularly effective in sour gas environments. One suitable C-276 alloy is available under the name Hastelloy C-276. Typically, the diaphragm may have a thickness of about 42 microns. Preferably, the diaphragm 22 is noble metal plated (preferably gold plating and more preferably 24K gold plating) on its exposed side to provide additional protection to the diaphragm against corrosion and hydrogen diffusion. The preferred thickness of the gold plating is from 5 to 8 microns. The Hastelloy C-276 material is utilized for all of the wetted surfaces inside the phantom box 24, including the threaded end portion 20 and integral hex nut 26. Any welding needed for assembly in this area of the transducer will be achieved without the use of filler. In addition, gold plating of the diaphragm takes place only after all welding has

been completed.

[0013] It is expected that the transducer as described will last as long as two years (i.e., approximately one billion cycles in H_2 reciprocating compressors with both sulfides and chlorides present in the gas stream, thus providing a significantly increased life expectancy for the transducer.

[0014] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.